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Enhancing Knowledge Sharing Among Higher Education Students through Digital Game

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Knowledge is valuable assets of organizations. One of the effective ways of creating new knowledge is highlighting knowledge sharing process among people. In this study the researcher tries to investigate the solutions for knowledge sharing problem in the classroom context. We have two objectives. One is to examine whether participants' decision-making process in knowledge sharing behaviour through digital game depend on their colleagues' knowledge sharing behaviours. The second is to examine the perceived payoff of sharing knowledge and specify if it can be characterized through the game theory. The descriptive study was carried out among 30 students from KLMU College in Malaysia. The result indicated the students' decision making to share their knowledge was dependent to peers knowledge sharing behaviours. In addition, the perceived payoff of sharing knowledge between the students could be characterized by an assurance game. Finally, the paper provides some implication for lecturers or managers who want to provide effective knowledge sharing in their classrooms or organizations.

Keywords: *Knowledge Sharing; Game Theory*

Introduction

Knowledge sharing has been recognized as the most important area in knowledge management and also is recognized the most important process for knowledge management (Halawi L., 2008) and according to Apostolou (2009) knowledge sharing has an essential effect on knowledge management outcomes. Increasing knowledge sharing among people has a positive effect on organization performance, but unfortunately, people do not share their knowledge under all conditions. They have enough reason that they do not share their knowledge as much as the organization would like them to share (Cho, Li & Su, 2007).

Several best practices have been exposed in methodical knowledge sharing phenomenon. According to Chua (2003) many questions about the sharing of knowledge, still have not been answered. As example; why some motivations are plans to promote effective knowledge sharing in some of organization, but they were not successful in others? Why do people share their knowledge passionately even they belong to the same organization? When is a person likely to share the knowledge? Therefore, the general knowledge sharing problem in many organizations is that employees with knowledge are unwilling to share their knowledge and existing knowledge is not being efficiently distributed through organizations.

The knowledge sharing problem is equally important for a knowledge based institutions, for example in the university landscape where the knowledge creation, dissemination and application is embedded in the institution, knowledge sharing among students is essential. In order to solve knowledge sharing problems, Bent (2007) mentioned knowledge is personal and for solving knowledge sharing problem should concentrate on individual behaviour in place of technology. Hendrix (2007) generate a knowledge sharing environment that concentrate on behaviour and education rather than just concentrate on technology, needed by staff and good performance. However, there are still gaps in recognizing when and why knowledge sharing happens. Therefore, this study investigates to advance findings on knowledge sharing by implementation a descriptive study that employs a game theoretical framework. There are two research objectives in our study. The first objective is to examine whether

participants' decision-making process in knowledge sharing behaviour through digital game depend on their colleagues' knowledge sharing behaviours. The second objective is to examine the perceived payoff of sharing knowledge and specify if it can be characterized through the game theory. Objectives of this study have implication for lecturers on how encourage the students to share their knowledge in the classroom context.
This study is structured as follows. Firstly, it argues the related literature on knowledge sharing and game theories. Following that a descriptive study was carried out to examine two propositions of this study. Then analysis the data that emerged from the study. Finally this paper presents the result and discusses some implication for lecturers or managers who want to provide effective knowledge sharing in their classrooms or organizations.

Literature Review

Knowledge Sharing

Some of the researchers have explored about the differences between knowledge and information. The former specified information as interpreted data via analysis, relationship and précis, and later specified Knowledge as meaningful information which is validated and enriched through experiment, values, beliefs and intuitions (Davenport & Prusak, 1999).

The previous studies categorized knowledge, knowledge to explicit and tacit. Polyani (1969) identified explicit knowledge as the knowledge that is organized, formal and codified into records for example libraries and databases (Cited in Nonaka 1994). Choi and Lee (2003) identified tacit knowledge as informal knowledge that is implanted in mental processes, is gained through work practices and experience, and it can be transferred by perceiving and implementing it. Some researchers defined knowledge sharing as the procedure by which persons jointly and repeatedly emend a thought, a belief or an offer in the view of experience. During the sharing process the initial idea might be increasingly changed or progressively refused (West & Meyer, 1997; Rogers, 1986). Knowledge sharing could be occurring through face to face communication (Dixon, 2000), synchronous

or non-synchronous communication with a digital knowledge storehouse (Lynne, 2001).

The basic goal is to employ existing knowledge to develop the group's efficiency (Alavi & Leidner, 1999; Salisbury, 2003). In the other words, each person shares what they learned and knew to those who have like to understand their knowledge and that knowledge is useful for them. The sharing procedure involves collecting, categorizing and communicating knowledge from one person to another (Van den Hooff & De Ridder, 2004). Since the sharing procedure includes other than collecting information and data, commonly, the value of knowledge increased while it is shared. Therefore, if controlled correctly, knowledge sharing could significantly enhance job-quality and decision- making ability, problem-solving effectiveness as well as proficiency that will help the organization (Yang, 2007).

Szulanski (1995) specified some impediments that hamper knowledge sharing like, dependability of source, motivation to share their knowledge, and ability to learn. According to these impediments, Sai and Sheng (2006) stated that individuals are unwilling to share their knowledge except there are obvious benefits for them. It is important to explicate individual knowledge sharing behaviour, to break down these impediments. Particularly, knowledge sharing is deeply social inherently; the knowledge sharing behaviour is affected by social elements such as care and trust. While social elements occurs through a mutual relationship between two persons who share and receive the knowledge then, knowledge sharing procedure only can be continued through reciprocal action (Chua, 2003).

Social Exchange Theory and Knowledge Sharing

The social exchange theory (Blau, 1964) examined individual's knowledge sharing behavior by using theoretical base. This theory mentioned that each person adjust their interactions with others based on personal interest and examination of profits and costs that they have gained during the interaction. Molm (2001) claimed that people try to increase their benefits and reduce their cost during interaction with others. According to Gouldner (1960) these profits not to be touchable while individuals participate in an

interaction with the supposition of interchange, In such transactions, people support each other with the hope of obtaining desired profits in future, such as achievement required resource throughout social reciprocity. Individuals try to make social interactions with others through sharing their knowledge to gain the maximum recourses. Davenport and Pruask (1998) examined the knowledge sharing behavior and summarized perceived advantages that might adjust such behavior. These advantages consist of the future of mutual relations, job security, position, and promotional prospects. Caberera (2005) claimed that knowledge sharing absolutely affected when a person supposes to gain some benefits in future through reciprocation. Previous researches revealed the elements which connected to social exchange theory can describe knowledge sharing behavior between people successfully.

Some of these elements are interpersonal interaction, personal cognition, and organizational contexts. For instance, Kankanhalli et al. (2005) highlighted that one of the most important factors that promotes employees to provide knowledge to digital knowledge repositories is an individual's perceived advantage. Ma and Agarwal (2007) claimed that quantity of knowledge that individuals share to virtual Communities relied on the degree of satisfactions that they obtain from other people of the community. Chiu et al. (2006) examined the impact of interpersonal elements like the norm of reciprocity, trust, and social interaction on knowledge sharing on virtual Communities. Lee and Kim (2006) researched about the effect of the organizational context on knowledge sharing. By considering the theory this study considers an individual knowledge sharing behavior depended on the knowledge sharing behavior of others. Therefore the first hypothesis is proposed:

H1: an individuals' decision-making process in knowledge sharing behavior through digital game depend on their colleagues' knowledge sharing behaviors.

Game Theories

When sharing of knowledge is considered as a result of decision that controlled by the perceived payoff, it has a several particular characteristics

which also exist in the framework of strategic games. At the beginning, the people that involve in knowledge sharing are generally identified inside a framework, in an organization. Additionally the process of sharing knowledge includes two or more people. In the same way, in strategic games needs two or more participants that play together. Secondly, in the domain of knowledge sharing, each person has to choose between two decisions, either to share or not to share the knowledge. At the same way, many strategic games contain a series of reciprocally selected strategies that players should choose one of them. Finally; the decision for an individual to share or not share the knowledge is depending upon the action which produces a more payoff (Chua, 2003).

Every player has a goal to choose a strategy that gained the highest payoff. Because of this reason, it is suitable to use game theory for the examination of knowledge sharing. According to Aumann (1987), game theory is a field of applied mathematics utilized as a unified field theory describes the logical parts of social sense, involving human and non-human players, for example; plants, animals, and computers.

The games will be used to stimulate real-life conditions usually involve five elements (Ho, Hsu & Oh, 2009):

1. A person who plays a game or make a decision
2. Strategies that is accessible for every player
3. Rules that control the behavior of players
4. Each player gain payoffs for each probable outcome

The outcome is an effect of special choices made by players from existing points. In strategic games, it's supposed that every player choose a strategy to gain the highest payoff. A dominant strategy performs better than other strategies without the consideration of the selections taken by other players. In a two-person game every player can select one of two reciprocally selected strategies; it means to participate or to shirk. Therefore there are four possible decisions that are created from two players. If suppose that the game is systematic, then the payoff for every player is similar when both of them participate or shirk. The payoff matrix of a two-person game is shown in Table 1, it is dependent on the payoff values i.e. a, b, c and d, a game can be categorized into one of three models are called,

prisoners' dilemma, chicken and assurance (Dixit & Skeath, 1999; Chua, 2003).

Table 1: Payoff Matrix (Chua, 2003)

Table I Generalised payoff table of a two-person game

		Person 2	
		Participate	**Shirk**
Person 1	Participate	a^a, a^b	b^a, c^b
	Shirk	c^a, b^b	d^a, d^b

Notes: [a]Payoff of Person 1; [b]Payoff of Person 2

Prisoners' Dilemma

If c>a, a>d, d>b, it is a prisoner's dilemma, an example of prisoners' dilemma shown in Table 2 and Figure1. According to Chua (2003); if player 2 participates, the payoff of player 1 is 7 if he/she participates and the payoff of player 1 is 10 if he/she shirks. If player 2 shirks, player 1 gains a payoff of 5 if he/she shirks and a payoff of 3 if he/she participates. Therefore in the two situations its better player 1 to choose shirks. The same situations exist for player 2 and he/she gains higher payoff through choosing shirk. Hence in the prisoner's dilemma the dominant strategy for each player is shirking. But, if both players select to shirk, each of them gains the payoff worse than a situation that both of them select to participate. To obtain highest advantage, every player requires collaborating with each other by selecting the dominated strategy (Kay, 1995; Chua, 2003).

Table 2: Prisoner's Dilemma (Chua, 2003)

		Person 2	
		Participate	**Shirk**
Person 1	Participate	7, 7	3, 10
	Shirk	10, 3	5, 5

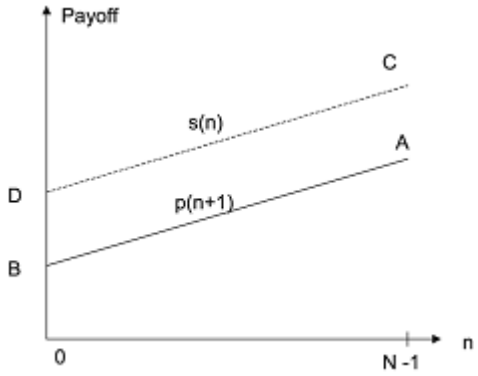

Figure 1: Prisoner's Dilemma
(Dixit & Skeath, 1999)

Game of Chicken

If b > d, c > a, it's a game of chicken, an example of a game of chicken displays in Table 3 and Figure 2. If player 2 participates, the payoff of player 1 is 7 if he/she participates and the payoff of player 1 is 10 if he/she shirks. In such situation, it's better for player 1 to select to shirk. If player 2 shirks, the payoff of player 1 is 5 if he/she participates and the payoff of player 1 is 3 if he/she shirks. In such situation, it is better for player 1 to select to participate. Therefore there is not a dominant strategy for each player in game of chicken. Instead, in this model it is better for each player to choose to participate if the other player shirks and choose to shirk if another player participates. Therefore the two of players can gain maximum advantage in their payoff by choosing the opposite strategy that is selected by the other player (Kay, 1995; Chua, 2003).

Table 3: Game of Chicken (Chua, 2003)

		Person 2	
		Participate	**Shirk**
Person 1	Participate	7, 7	5, 10
	Shirk	10, 5	3, 3

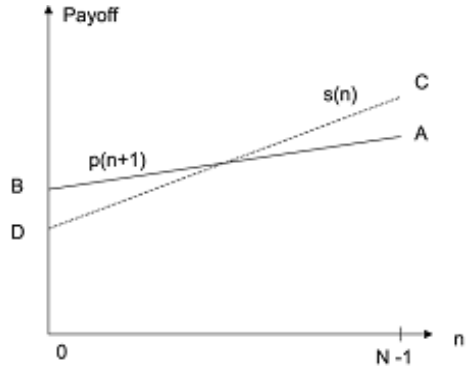

Figure 2: Game of Chicken
(Dixit & Skeath, 1999)

Assurance

If a > c, a > d, d > b, it's a game of assurance, and an example of an assurance game displays in Table 4 and Figure 3. If player 2 participates, player 1 gains the payoff of 7 whenever he/she shirks and gains the payoff of 10 whenever he/she participates. In such situation, player 1 gains maximum benefit by selecting to participate. If player 2 shirks, the payoff of player 1 is 3 whenever he/she participates and the payoff of player 1 is 5 whenever he/she shirks. Consequently, player1 needs to choose to shirk for gaining maximum advantage. Therefore there isn't a dominant strategy for each player in an assurance game. Instead, each player must have the same strategy that other player has, it means that the player is better to participates if the other one participates and to shirk if the other one shirks, by using this strategy they can gain maximum payoff (Kay, 1995; Chua, 2003).

Table 4: Game of Assurance (Chua, 2003)

		Person 2	
		Participate	**Shirk**
Person 1	Participate	10, 10	3, 7
	Shirk	7, 3	5, 5

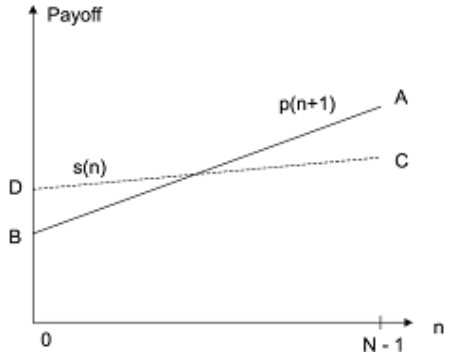

Figure 3: Game of Assurance
(Dixit & Skeath, 1999)

As discussed earlier, when an individuals' decision to share the knowledge is depended the knowledge sharing behavior of others, then it is match with the structure of a strategic game. Therefore the second hypothesis is proposed:

H2: The individual perceived payoff of sharing knowledge can be characterized by two-person game in game theory.

Methodology

The descriptive study was used for this research through online survey is classified the research as a quantitative study. In this study the participants were students from two classes of KLMU College based in Malaysia to attend in educational games in Second Life as a digital game. For the purpose of this research each of two players has been placed in one group in the game. The participants could play the game in twice a week according to their classroom timetable.

Second Life is three dimensional (3-D) and full immersive application based on internet completely built and owned by its residents in virtual world. Second life provides synchronous and asynchronous virtual tools.

Technically, the questionnaire is divided into two main divisions:

Section A: Demographic information: The first division of the survey contains the questions as regards the general information about students and they are prompted for their personal characteristic. The four characteristic of students were identified includes: (1) Gender; (2) Educational level; (3) Age; and (4) Computer skill of participants

Section B: Describes the knowledge sharing practice. The second division contains twenty questions about knowledge sharing behavior of students during playing the digital game. The five items considered to measure knowledge sharing behavior of students during playing the digital game:

1. Level of understanding about the topic of the game
2. Efficiency in doing the tasks
3. Self-esteem
4. Sense of recognition by peer
5. Effect of knowledge sharing of peer on decision making of students to share their knowledge

This division of questionnaire compromised four divisions within which these five items are presented. The four level of knowledge sharing practice of the respondents are D1, D2, D3, and D4. The aim was to calculate the students' perceived knowledge sharing in dissimilar situations and these divisions have been concluded: (D1) the researcher assumed that both of player and his/her peer share the knowledge during playing the game, (D2) the researcher assumed that the player shares the knowledge but his/her peer does not share the knowledge during playing the game, (D3) the researcher assumed that the player does not share the knowledge but his/her peer shares the knowledge during playing the game, (D4) the researcher assumed that neither player nor his/her peer share the knowledge during playing the game.

These situations are illustrated in Table 5.

Table 5: Four Situations in Knowledge Sharing

		Player 2	
		Participate	Avoid
Player 1	Participate	D1	D3
	Avoid	D2	D4

Data Collection and Analysis

The survey tool was managed by an online questionnaire. The online survey tool was developed on My3Q website. The period that survey got distributed was May 14 to May 28, 2012. Invitation emails having a hyperlink to the online questionnaire were sent to a sample of 34 students. A reminder mail was sent to the respondents after one week again. But as the statistic shows, only 30 participants went through online questionnaire during the survey time. Characteristics of participants are shown in Table 6. After that, Table 7 shows Cronbach's Alpha, standard deviation and mean scores gained from four situations in the survey.

The researcher calculated the reliability test since it provides validity. Using the data file and calculating the reliability test, Cronbach's Alpha for the four situations are shown in Table 7. Several researchers like Cooper and Schindler (2006), and Iacobucci and Duhachek (2003) asserted that, as a rule of thumb, a reliability test should be 0.7 or above. For testing H1 and H2, it was suitable to employ ANOVA and T-Test. By applying ANNOVA test, D1, D2, D3 and D4 were gained to have different variances ($p < 0.05$). It indicates that in different situation the student's perceived payoff of knowledge sharing was different through digital game and depended on their colleagues' knowledge sharing behaviors. Thus H1 is proved.

In T-Test by comparison of D1, D2, D3, and D4, the researcher found that mean of D1 is higher than mean of D3, and mean of D2 is higher than mean of D4. The first inequity $D1>D3$ ($p<0.05$) means that when the peer of the student shared the knowledge, it is more significant for the student share the knowledge rather than did not share the knowledge, and the second inequity $D2<D4$ ($p<0.05$) means that when the peer of the student didn't share the knowledge, it is better the student did not share the knowledge rather than share the knowledge. This structure matches exactly with the assurance game structure. Thus H2 is supported.

Table 6: Characteristics of Participants

Description		Frequency	Percentage
Gender			
	Male	17	56.7
	Female	13	43.3
Education Level			
	Diploma's Degree	3	10.0
	Bachelor's Degree	27	90.0
Age			
	18-24	18	60.0
	25-34	12	40.0
Computer Skills of the Respondents			
	Minimum Knowledge	5	16.7
	I use regularly	15	50.0
	I am proficient	10	33.3

Table 7: Descriptive Statistics and Cronbach's Alpha of Four Situations

	Mean	Std. Deviation	Cronbach's Alpha
S1	4.2067	.59069	. 0.7321
S2	2.2467	.48901	. 0.7116
S3	3.1467	.38213	. 0.7812
S4	2.4133	.47831	. 0.7992

Discussions

Firstly, because of D_1, D_2, D_3 and D_4 were gained to have different variances; it means that a student's perceived payoff of knowledge sharing

was different through digital game and depended on their colleagues' knowledge sharing behavior s. The concept of payoff represents all of willingness and interests of students to share their knowledge while their peers share their knowledge. Therefore, the proof of H1 means that a student's decision-making to share the knowledge is affected by the knowledge sharing behavior of his/her peer. Secondly, as it is shown, the most significant division is D1, followed by D3, D4, and D2. This statistic shows D1 has the highest score of mean in knowledge sharing behavior when both of the players shared their knowledge during playing game and they got most satisfaction in this situation. By comparing D1 and D4, the finding specified that both of the players desired to share their knowledge during playing the game rather than not to share their knowledge. By comparing D2 and D3, the findings specified that the player was satisfied when his/her peer shared the knowledge during playing the game and this situation had some positive effect on knowledge sharing behaviors of students.

Finally, ($D_1 > D_3$) means that when the peer of the student shared the knowledge, it is more significant for the student share the knowledge rather than did not share the knowledge, and ($D_2 < D_4$) means that when the peer of the student didn't share the knowledge, it is better the student did not share the knowledge rather than share the knowledge. This structure matches exactly with the assurance game structure. Thus H2 is proved.

Conclusions

The lack of knowledge sharing is one of the most important problems in knowledge management area. To solve this problem, this research tried to use a game theatrical framework for students who played digital game in the classroom context. The descriptive research was done among students in a higher education institute and the concept of knowledge sharing was limited to interaction of students during playing the digital game. This research showed that use of digital game in the classroom context was a successful way for enhancing knowledge sharing among students and it presented a digital game supported effective knowledge sharing between students. By analyzing the data in this research, it was proved; firstly an

individual's decision to share the knowledge was dependent on the knowledge sharing behavior of his/her peer.

Secondly, the perceived payoff of sharing knowledge between two students can be characterized by assurance game. This view helps to describe for what reasons some incentives are successful in some organizations but be unsuccessful in other organizations. This study showed by using the digital game and providing suitable environment, it is possible to promote students to share their knowledge and increase the interaction between them. The results of this study have the following implications for managers and lecturers who want to enhance knowledge sharing among their students and their employees. It is necessary for them to recognize the concerns of their students and employee then provide a particular intervention to improve knowledge sharing process.

Appendix

Survey

Demographic Information
1-Your gender
(1) Male (2) Female
2-Your Education Level
(1) Diploma's Degree (2) Bachelor's Degree (3) Master's Degree (4) PhD degree
3-Your Age
(1) 18-24 (2) 25-34 (3) 35-44 (4) 55 >
4-Your Computer Skill
(1) No Knowledge (2) Minimum Knowledge (3) I use regularly (4) I am proficient
Knowledge Sharing Practice
Division 1: Assuming that BOTH you and your per share the knowledge during playing the game.
5-How do you think this situation will affect your level of understanding about the topic of the game?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

6-How do you think this situation will affect your self-esteem?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot
7-How do you think this situation will affect your sense of recognition by your peer?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot
8-How do you think this situation will affect your efficiency in doing your tasks?
(1) A lot of negative affect (2) some negative affect (3) Neutral (4) some positive affect (5) A lot of positive affect
9-How do you think the level of knowledge sharing of your peer affect your decision to share your knowledge?
(1) A lot of negative affect (2) Some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect
Division 2: Assuming that you share the knowledge during playing the game but your peer DOSE NOT.
10-How do you think this situation will affect your level of understanding about the topic of the game?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot
11-How do you think this situation will affect your self-esteem?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot
12-How do you think this situation will affect your sense of recognition by your peer?
(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot
13-How do you think this situation will affect your efficiency in doing your tasks?
(1) A lot of negative affect (2) Some negative affect (3) Neutral (4) some positive affect (5) A lot of positive affect
14-How do you think the level of knowledge sharing of your peer affect your decision to share your knowledge?
(1) A lot of negative affect (2) some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect

Division 3: Assuming that your peer shares the knowledge during playing the game but you DO NOT

15-How do you think this situation will affect your level of understanding about the topic of the game?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

16-How do you think this situation will affect your self-esteem?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

17-How do you think this situation will affect your sense of recognition by your peer?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

18-How do you think this situation will affect your efficiency in doing your tasks?

(1) A lot of negative affect (2) Some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect

19-How do you think the level of knowledge sharing of your peer affect your decision to share your knowledge?

(1) A lot of negative affect (2) Some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect

Division 4: Assuming that NEITHER you nor your peer share the knowledge during playing the game.

20-How do you think this situation will affect your level of understanding about the topic of the game?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

21-How do you think this situation will affect your self-esteem?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

22-How do you think this situation will affect your sense of recognition by your peer?

(1) Lose a lot (2) Lose some (3) Neutral (4) Gain some (5) Gain a lot

23-How do you think this situation will affect your efficiency in doing your tasks?
(1) A lot of negative affect (2) Some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect
24-How do you think the level of knowledge sharing of your peer affect your decision to share your knowledge?
(1) A Lot of negative affect (2) Some negative affect (3) Neutral (4) Some positive affect (5) A lot of positive affect

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